MOTOROLA
NEWS GRAM

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In This Issue . . .

Contracted maintenance by Motorola keeps the extensive 2-way radio network operated by the Kansas Turnpike Authority at peak efficiency. See pages 18-19.

Miniaturization, Sub-Miniaturization, Microelectronics, Molecular Electronics, Monolithic Circuitry

You are familiar with some of the terms in the title of this article. When miniaturization failed to meet our need for size reduction, we went to sub-miniaturization. Now the terms "microelectronics," "molecular electronics," and "monolithic circuitry" are competing for acceptance as the designating term for the ultimate in size reduction for functional circuit complexes. Miniaturization and sub-miniaturization were concerned principally with reducing the size of circuit components and combining them into tiny 3-dimensional structures of functional circuit units. This approach to size reduction very rapidly reached practical limits. Not only is there the problem of controlling heat dissipation as the components become smaller in size, and as they are more closely packed together, but there is also a more serious problem of insuring a suitable level of reliability. Certainly, the development of sub-miniaturization devices was stimulated substantially by the availability of semiconductor components which decreased the necessary size of the active elements, decreased the required operating currents, and substantially increased the expected life and reliability. Any additional substantial reduction in the size of functional units, beyond our present pocket equipment, cannot be achieved by the refinement of present sub-miniaturization techniques. A radical departure from the principle of packing smaller and smaller components into less and less cubicle contents is essential to any further progress in size reduction. There is a promising new approach to size reduction. This radical departure is variously referred to as "micro-electronics" or "molecular electronics," and structure resulting from the application of this new technique is sometimes referred to as a "monolithic" device or circuit unit.

In the Motorola Solid State Electronics Department, we prefer to call the new techniques "microelectronics." I think the radical change in technique can best be characterized by the statement that there may be no identifiable components in the structure of the ultimate functional device produced by microelectronics. With microelectronics, a complete multivibrator circuit element, an oscillator, an amplifier, or some other similar functional unit may become a solid "hunk of stuff" which may vary in size anywhere from that of the head of a pin to the head of a match. I suggested that the chief difference between subminiaturization and microelectronics is that there are no identifiable circuit elements in the microelectronic structure. In general, it may be said that the materials themselves become the circuit elements when they are put down in proper layers of thin films. Conducting layers, dielectric layers, active non-linear circuit layers, and layers of high resistivity material may be built into a solid block. Complete functional circuits of the type I have described have been successfully made in this monolithic form. We are obviously a long way from low-cost production of monolithic structures, but the trend is inescapable and the development of reliable, high-performance, micro-sized units is inevitable.

It is my belief, or perhaps I should say, it is my fond hope, that the maturing of the techniques for the production of monolithic circuit structures will produce elements with several orders of magnitude improvement in reliability. Reliability improvement is the most important single factor which may limit continued progress in the electronic field. As our art matures, it is quite evident that there is an exponential rise in the complexity of our circuitry configurations. Any effort of continue piling complexity upon complexity with the present methods of inter-connecting thousands upon thousands of components must result in steadily decreasing reliability. If we continue this trend without limit, we shall ultimately reach the point where maximum complexity and zero reliability meet.

The development of the transistor and semiconductor devices, in general, provided us with new dimensions for building complex devices with reasonable reliability, but our demands for extended performance are increasing so rapidly that our need for complexity will soon out-distance the inherent capability of achieving acceptable reliability as we continue to make use of more and more interconnected components. Someday we shall have, in a single monolithic circuit block, the equivalent of anywhere from a hundred to a thousand components. When one circuit monolith takes the place of a thousand components, this tiny, single unit will thus become the equivalent of a functional module. Several of these monolithic circuit structures can be combined to form larger modules. Maintenance will be a matter of checking whole module functional structures, with repair achieved through the replacement of defective modules rather than by replacing defective components. It would be our wish that, with the development of the equivalent of a thousand-component functional circuit in a single monolithic structure, we could increase the complexity of future electronic systems a thousand-fold without decreasing the potential for reliability. This, at present, must be our hope for continuing progress in the electronics art.

It is obvious that microelectronics lends itself particularly to the development of all missile electronics, and all airborne electronics equipment. Similarly, microelectronics will provide new dimensions for personal electronic devices where size and weight are of dominant importance. For example: selective calling devices are, at present, rather costly and complex units. Ultimately, the active element of a digital selective circuit system will be contained in a single unit the size of a postage stamp, and not much thicker. We are moving toward a new era of electronic growth.

For about forty years, we have been developing electronics around the vacuum tube device. Solid state electronics and microelectronics are new arts. They are not nearly so much a continuation of the electronic circuitry and equipment development started with the vacuum tube as they are the redirection of the art, starting from a new and different base. The next forty years of electronics are going to be most interesting, and every achievement of vacuum tube circuitry will be surpassed. All of the standards of performance, complexity and reliability will be exceeded by several orders of magnitude. Things are certainly stirring in the electronics art, and the future developments in the field will eventually touch every man and woman in the world. Anyway, we can all be sure that there will be little chance for boredom. » » »

Sincerely,

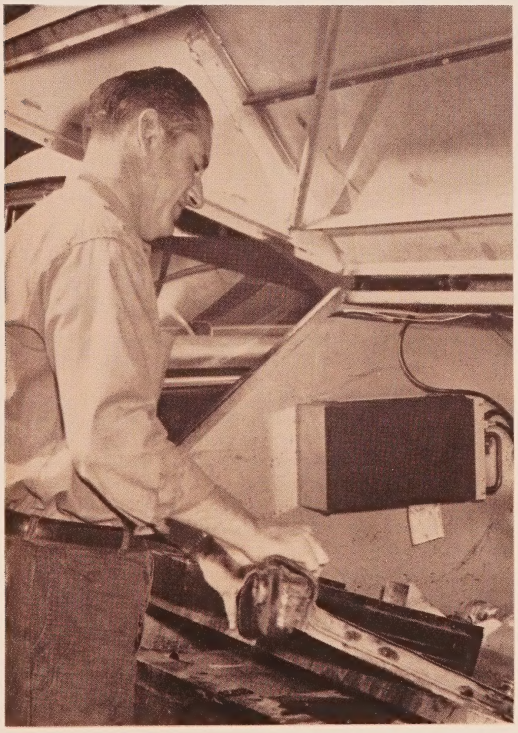
Dan Noble

TWO-WAY RADIO CUTS 35,000 MILES ANNUALLY

Motorola base station provides 100 watts output power for R & S radio system. Control board provides accurate record of calls for radiator department business.

R & S serviceman uses 2-way radio to check in at office after completing a call. He is immediately routed to call nearest his location, thus eliminating need for backtracking.

Frank Stewart loads repaired radiator in special delivery truck. Motorola mobile radio unit is mounted on truck wall.



"Before the installation of Motorola 2-way radio we wore out our truck every year", says Frank Stewart, operator of automobile radiator department of R & S Service Company, Kansas City, Mo. "Since then, we have cut 35,000 miles per year and our truck has lasted three years."

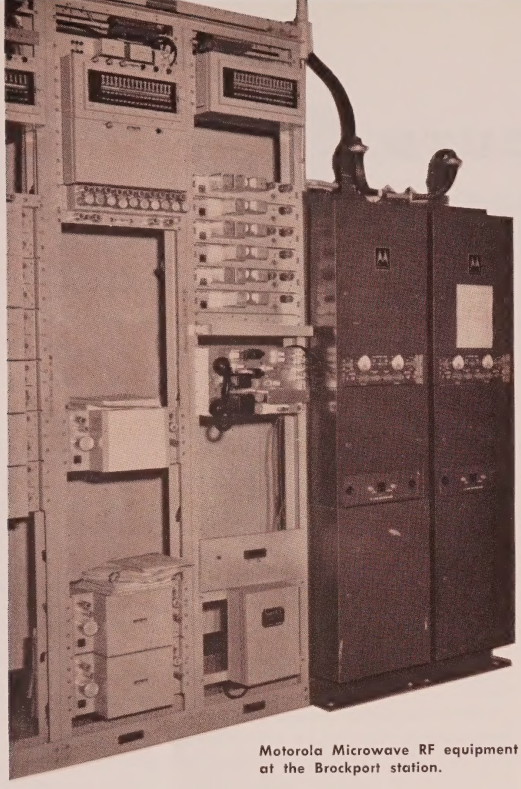
Stewart originally became acquainted with two-way radio by leasing service from a Miscellaneous Common Carrier. Late in 1958, the Federal Communications Commission authorized the Business Radio Service, making any bona-fide business eligible for its own radio communications system.

It was at this time that R & S installed its own Motorola two-way radio network, which is being used by both the radiator repair department and an Appliance Service business operated by Frank's brother, Ed. The new radio system consists of a central base station at the shop, and 10 mobile units that are installed on the various service trucks and cars. One of the trucks is used full time by the radiator department; the others are used by the appliance service man.

Included in the system is an 82-foot self-supporting antenna tower whose height, together with the 100 watts output of the base station provides R & S full coverage of the entire metropolitan Kansas City area. Frank Stewart explains that with radio the base station can relay pickup and delivery orders to the trucks in the field, cutting vehicle expense, saving manpower and providing faster customer service. Since there are 28 other radiator repair shops in Kansas City, customer service is a most important asset in selling R & S. Here is an example of how the system is used every day:

The truck may be delivering a repaired radiator to a service station on the far side of Kansas City. Another station would call requesting that a faulty radiator be picked up and repaired. With radio the driver is contacted immediately. He can drive to the pick-up spot as the delivery is completed, saving an entire extra trip to and from the shop.

The radio system is being leased from Motorola. Included in the contract is a Motorola Maintenance Agreement which provides for periodic, preventive maintenance checks of all equipment as well as immediate attention to any emergency call. » » »



Motorola Microwave RF equipment at the Brockport station.

MOTOROLA MICROW

Motorola equipment cuts cable requirements, minimizes maintenance, and results in overall economies in the expansion of Rochester Telephone Corporation facilities

In 1957, the Rochester, New York Telephone Corporation needed additional toll circuits between its main toll center and the Brockport, New York central office, located 19.2 route miles from Rochester. Increased toll use, addition of crossbar tandem in Rochester and the requirements connected with direct distance dialing created a need for more toll, private line and foreign exchange circuits than the existing 20 wire and carrier channels to Brockport. Another end office on the same route, Spenceport, needed 11 circuits more than the available 25.

Stringing extra wire would not meet the anticipated requirements, because the route already had four full crossarms. It was not practical from an engineering standpoint to add more carrier, since crosstalk and storm hazard would create a disadvantage. The open wire is routed on what formerly was a tow path on the Erie Canal and original access was not difficult. However, this tow path had since become overgrown by trees and rutted by erosion. Maintenance costs on the open wire were high.

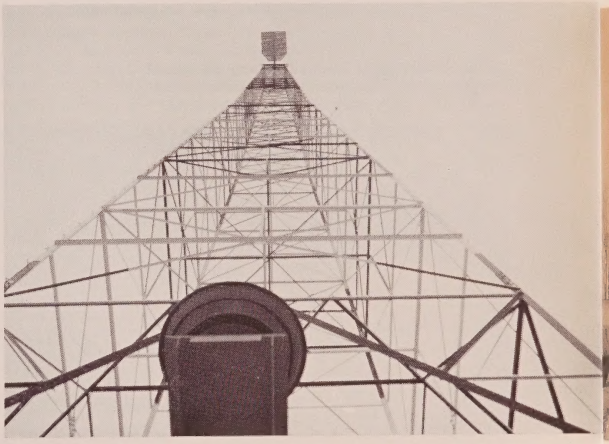
The three solutions available were to put in cable, cable plus carrier, or microwave.

There would be a need for 200 circuits betwen Rochester and Brockport in 10 years. This estimate was based on plans for extended area service, direct distance dialing and natural community growth. Brockport currently has a manual switchboard and is operator office for the community dial office at Hamlin. Rochester will ultimately be the Operator Office for both branches.

The immediate reaction by the Rochester firm was to "put in cable". The cable system with loading and repeaters providing 200 circuits would cost $430,000. A microwave system with enough multiplex to provide 200 circuits would be $470,000—$40,000 more.

But it was known the company had immediate need for only 36 circuits. Full realization of the 200 total was 10 years away. But the cable system would have to be installed at once, except for some leads, repeaters and carrier terminals.

During the 10-year growth, the company would have to pay interest on the unused portion of cable, specifically



Tower at Brockport showing the paraboloid near the base and the passive reflector at the top which sends the signal to Rochester.

taxes and maintenance, and would lose money through depreciation. These carrying charges amounted to about $64,000 a year. The carrying charges on the investment in microwave equipment, would be about $28,000 per year, a savings of $35,600.

With Motorola microwave, the Rochester firm could initially install the RF equipment, with towers and antennas, emergency power units and just enough multiplex to handle present needs. As the requirements for circuits grew, it could install the added multiplex equipment.

Initial microwave cost was $142,000 and included multiplex equipment for 36 circuits. Multiplex for each additional circuit would cost about $2,000. Total investment in microwave, with 200 circuits, would be about $470,000. As each portion of the system went into service, it would

WAVE PROVIDES THE SOLUTION

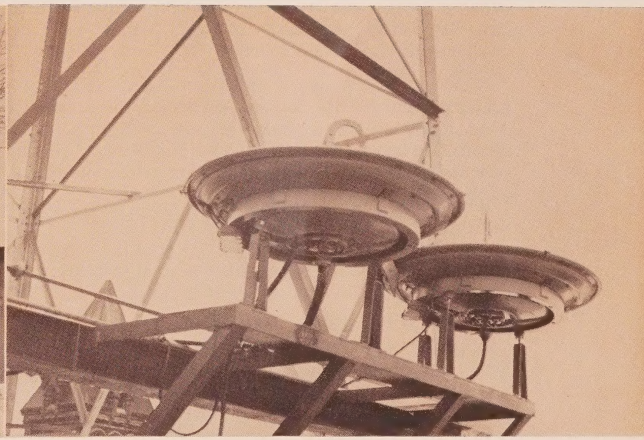
be revenue producing and thus more than making up the cost difference between cable and microwave.

In addition to monetary considerations, timing was another important element favoring microwave. The extra circuits were needed quickly. The microwave—surveyed, engineered and installed — would go into service with a minimum of use of the company's regular work force, since the only wiring needed would be performed in the two terminal offices. At the time Rochester's crews were tied up for lengthy periods in crossbar tandem trunk installation and other expansion and dial conversion projects.

Once Motorola microwave was adopted, according to Donald H. Campbell, President of the Rochester Telephone Corp., "The speed of the entire project was astounding. The Brockport line-of-sight survey was ordered in March, 1957. The system cut over took place just nine months later—January, 1958."

A single hop link was established. One tower was placed on the roof of a toll office in downtown Rochester and the lower portion of the other, a 245-foot self-supporting tower, enclosed an addition to the Brockport central office building.

Base of the 245-foot tower at the Brockport central office building. Paraboloid shown is part of a one hop link to Rochester.



Dual paraboloids at the base of the antenna tower at the Rochester station where the company's toll office is located.

Campbell lists five results of microwave from a system viewpoint as: 1) increase of toll circuits to Brockport from 20 to 36; 2) switch over of 17 of the former Brockport circuits to the Spencerport office to relieve the load there; 3) increase of circuits to enable a reduction in delay probability to both Brockport and Spencerport to .03, the suggested value for final routes to end offices; 4) keeping of Rochester facilities free for lower cost expansion within the city, and 5) elimination of right-of-way problems, since no poles are needed.

The Rochester corporation cut over its second new Motorola microwave system in April of 1958. It replaced an earlier system providing circuits to Caledonia, New York, a CDO of Rochester, and Geneseo, a toll center 30 miles south of Rochester.

The original equipment, installed in June, 1957, provided 80 circuits, 50 dropped off at Geneseo and the others taken back to Caledonia. A few months, later, with the firm feeling the need for increased reliability and a higher channel capacity, the system was reengineered with Motorola RF units installed. Motorola wide band gear enabled multiplexing 240 circuits. Only 90 had been used on the old system.

The Motorola frequency diversity system provided the firm with the reliability standards needed, according to Campbell. By this system, the same intelligence is transmitted simultaneously on two separate frequencies. At the receiver, a unique Motorola sensing device decides at each instant which signal is better, and that one is used. The frequency diversity technique overcomes the effects of fading, since the conditions may cause difficulties with one frequency, but not with the other.

Maintenance of the radio equipment itself is no great problem, according to Campbell. The Motorola equipment operates in the 6,000 mc region, enabling use of very long lived low power reflex klystron transmitting tubes, and positioning of antenna dishes in horizontal positions at ground level. The beam is transmitted to the top of the tower where it is bounced by a passive reflector to the next station. All electrical connections are on the bottom of the tower, and there is no need for expensive, difficult-to-maintain coaxial cable.

Campbell predicted the growing demand for increased service will make additional expansion of the system a necessity within a few years. "There is no doubt in our minds that microwave will be used elsewhere when it can be proven in economically and technically," he said. » » »

"EACH RADIO IS

More than a few eyebrows raised when word got around that Hodges & Sons of Ft. Lauderdale, Florida, had installed a 2-way radio system. Radio was all right for businesses operating large fleets—but what possible use could it have in the real estate field?

Now, years later, any skepticism has long since disappeared. Many of the doubters have themselves adopted 2-way radio, not only in real estate and insurance activities such as Hodges is engaged, but also in such numbers and varieties of enterprises that it almost precludes the telling.

Bob Hodges, who operates the business in partnership with his father and brother, claims that each of his firm's mobile radios virtually takes the place of at least one additional salesman. The same holds true in the insurance activity in which Bob and his brother are engaged.

"Since we installed our radio system," Bob points out, "we have come to rely on it so greatly that we don't know how we would get along without it—outside of sacrificing a great deal of business efficiency and volume."

A look at the Brower County and Ft. Lauderdale activity reveals why immediate and efficient communication is so important. This area hasn't "mushroomed" in the past few years—it has "exploded".

This locale, scarcely more than a hamlet when R. L. Hodges started in the real estate business there back in 1924, now has a population of 350,000. A growth to 420,000 is expected in five years and an additional zoom to 670,000 is predicted in ten years. The rate of climb has been 175 percent since 1950.

Obviously, the perimeter of the seaside city is being constantly expanded. Streets that once were lightly traveled "country" roads now are paved, traffic-choked thoroughfares that make traveling a time consuming effort. Here's where radio has really come into its own.

"Showing property is our business, and to show it, varying amounts of travel are involved," Bob explains. "Our clients range from the prospective buyer of a small home or lot to organizations seeking sale, lease or purchase of the larger commercial, industrial and even agricultural properties.

"These clients and customers sometimes call at our office; we may pick them up at their homes, places of business or other stated locations; or we may meet them at the site of the property involved. In any event, we are in constant contact with our office through our Motorola 2-way radio system.

"There are some definite advantages to this. For instance, if I am out with a prospect and a question arises either at the office or with one of our other salesmen involving a problem with which I am most familiar, I can answer it or indicate a possible solution while driving. This incidentally is frequently very impressive to the customer and adds greatly to our prestige.

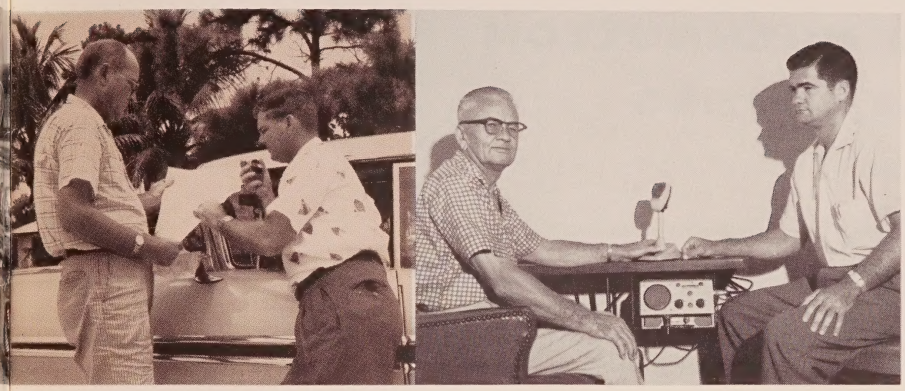
"Such communications can be carried out either between my car and the office, with either or both of the mobiles used by my father and brother, or between the office and all of our cars. We have very few problems that can't be ironed out immediately in this manner. Activities such as this are impossible without 2-way communications."

To further illustrate his firm's use of 2-way radio Bob elaborates:

"On reaching a property site with my client or customer, I check out with our dispatcher and usually leave the auto while the property is being shown. Any question my customer may broach which I can't readily answer can usually be resolved through a quick radio call to the office.

"Perhaps the customer is not too interested in the particular property being shown, but would like to see others. Normally, we would anticipate this and would be prepared with necessary information. However, conversation with

LIKE AN ADDITIONAL SALESMAN"



In a typical application of the Hodges Motorola 2-way radio system: (1) the receptionist, while talking to a prospective customer on the phone uses radio to contact (2) Bob Hodges, who shortly before reported conclusion of another appointment. (3) An appointment with the customer is made, and Bob is soon with the customer looking over the property. (4) Should any question arise as to this particular listing, Bob can usually resolve such problems quickly merely through a radio "conference" with his father and brother. Since all three of the Hodges have 2-way radios in their cars, such conferences also can be conducted on a mobile basis.

the prospect may have revealed that another listing would be more to his liking."

Herein is another benefit of 2-way radio, he continues. Out-of-date listings are a complete waste of time, and communication afforded through radio keeps Hodges listings up-to-date. Salesmen never find themselves in the embarrassing position of showing property that has already been sold or rented to another customer. He simply contacts the office and obtains information on other listings.

"At any time while we are in our cars, we can receive information that we have an office customer or that someone has called for an appointment," Bob goes on. "We can pass on the information as to when this customer can expect us and arrange our operations accordingly. This may be a prospect who's ready to 'sign' and with whom we've spent considerable time. We wouldn't want to keep him waiting.

"Or, one of us may just have dropped off a customer, and have so indicated via radio, when we learn that another client has called while we were out. We can either stop at the nearest phone booth and contact him or we can go immediately to his location and have our office notify him of this fact. Such service is important. In addition, it saves uncounted miles of traveling, since one of us frequently is in the immediate vicinity when such a call comes through."

Besides its sales and rental activities, Hodges also owns a plush 20-unit motel, the Casa Playa, which is located on the ocean. While this hostelry has a manager, questions frequently arise with which the office can help him. Since so much of the partners' time is spent outside of the office, radio is important in enabling the manager to reach them when necessary.

Basically, many of the benefits realized from radio in real estate activities are intensified in the Hodges brothers' insurance efforts. Although they write considerable coverage of almost everything except life insurance, they nevertheless regard the insurance business as a sideline.

Yet, they have found their Motorola 2-way radio system invaluable in providing a "traveling office". They can be out checking listings when a claim call comes through, for example, and with radio contact, the office informs them of the nature and location of the claim and they can be on the scene in the shortest time possible.

They can give instructions as to whether or not they'd like a photographer on the scene, or they can put in motion the many normal activities necessary in providing the prompt claim service that clients have learned to expect.

"We are firmly sold on 2-way radio communications," Bob emphasizes. "It has kept the number of salesmen required to a minimum, saved us countless miles of backtracking and wasted mileage, has actually made our work easier while more efficient and, in general, has proved itself one of our best service tools." » » »

Hodges headquarters on Ft. Lauderdale's famed Sunrise Boulevard, is hub of the firm's radio coordinated real estate and insurance activities.

NORTH DAKOTA UTILITY PIONEERS PUSHBUTTON RADIOTELEPHONES

Two high gain antennas in the Parshall mobile radio telephone system are supported by this 300-foot steel tower.

This is Parshall, as seen from the telephone company's antenna tower site 1 mile out of town.

One of the first installations of Motorola fully automatic pushbutton radiotelephone equipment in the entire nation was recorded this year by the Reservation Mutual Aid Telephone Corporation of Parshall, North Dakota.

The new system, the first phase of which went into operation this past March, incorporates unattended dial exchanges and mobile telephone service. In the past, this was a near impossibility for small independents. The company expects to have 45 subscribers in its mobile service by the end of this year.

Some 2,500 subscribers in the central North Dakota farm, ranch and oil country around the Garrison Reservoir are served by RMATC through 13 unattended dial exchanges. The need for mobile telephone service became apparent, says Fred Ahlgren, Manager of Reservation Mutual, when the Williston Basin Oil field activity moved into the territory.

Through a 1957 survey, Ahlgren found 55 potential mobile customers in his territory. Included are oil field supply firms, his own service vehicles, ambulances and schoolbuses. The Manager decided against dispatch type service. He had diagnosed a need for two base stations if the entire territory was to be adequately covered. He ascertained that providing 24-hour operator service at both exchanges would be too costly, and only one of his prospects had indicated satisfaction with 8-hour service.

Ahlgren secured an REA loan and contracted with Motorola for the installation of two of its recently-developed automatic dial mobile radiotelephone systems. Each system has a capacity of three 10-party loops. The two radio base stations and termination gear for the first loops were installed early in 1959. Second and third loops at each exchange are earmarked for later in the year.

LEFT,

Motorola Service Station operator in Parshall, Herb Stall, checks the dial system termination chassis in the Parshall exchange.

CENTER,

A Reservation Mutual lineman uses the pushbutton dial radiotelephone in his truck to place a call to another company truck.

RIGHT,

Ahlgren surveys Motorola radio base station in transmitter shack at the base of the antenna tower in Parshall.

The first station was set up at the Keene, North Dakota, exchange in the oil field region of Reservation's area. The second was installed at the Parshall exchange, RMATC's headquarters. First of the Parshall subscribers were six company Reservation vehicles—five service trucks and Ahlgren's car. Others included a school bus, doctor and the Motorola Service Station.

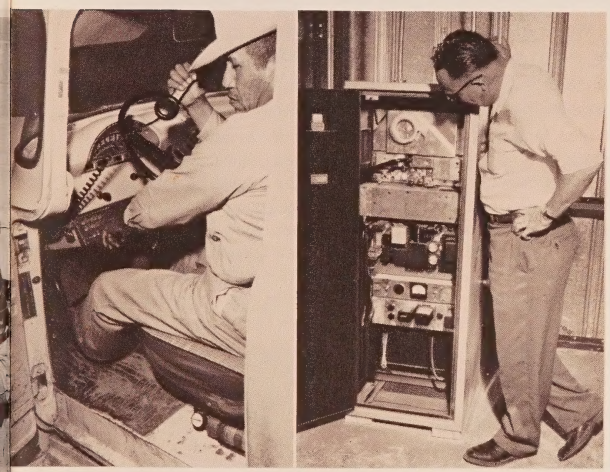
At Keene, nine of the first 10 numbers went to oil fields. Two units were fixed on drilling rigs and the others in vehicles of drilling supply firms. The doctor on the Parshall exchange carries a two frequency mobile unit and has

an independent number on the Keene exchange, enabling him to receive direct calls from patients in a 90-mile area without their paying toll fees. The remaining 20 numbers to be available at the Keene exchange later in the year will be sold in the oil fields. A projected second system in this area will increase capacity beyond the present 30.

The demand is not as heavy at Parshall, Ahlgren reports. Seven school buses will be served on the second and third loops, and prospective customers also include the local fuel oil dealers and the Parshall police chief. The chief's mobile radio is set to the county sheriff's frequency, and with a mobile telephone in his car as well, local residents could call direct when help is needed.

Ahlgren figures to easily justify his investment of $70,000. The system proves out at 30 subscribers and at present he has active prospects for 45.

The mobile service rate was fixed at $35 a month for units having a number on one exchange and $45 per month for those with numbers on both. This requires a dual frequency unit and also ties up an additional exchange number. Reservation Mutual also charges a fixed fee of $40 per unit for installation and removal.



Ahlgren feels the six units in his own vehicles bring a greater revenue return than if they were used by subscribers. The reason, he says, is the ability to closely control his maintenance force which must cover a 3,500 square mile area. A $4,800 annual operating expense reduction results from usage of the equipment.

The RMATC mobile dial systems combine standard Motorola radio equipment with recently developed switching and base station signalling equipment using 150-170 mc frequencies and high gain antennas, located at each mobile dial exchange. Connected to the station are telephone switching chassis which tie into a regular 10-party subscriber wire line. The radio stations and emergency power generators are housed in eight-by-ten steel buildings at their respective antenna tower sites. At Parshall, about a mile out, a 300 foot guyed steel tower supports the two high gain antennas. At Keene, a 100-foot wooden utility pole serves as the tower. The site is about one-half mile from the eychange. The base stations are connected by wire lines to switching terminal chassis located in exchange buildings.

The mobile equipment consists of 25-watt Motorola "T-Power" radio units and the special pushbutton dial control heads. Each system has a range of 35-40 miles, with coverage as great as 55 miles, depending on the location of the mobile unit.

It is easy to place a call from a mobile unit. The transmitter sends out a tone signal to the base station when a subscriber picks up his mobile handset. The base makes a connection to the dial telephone exchange and the subscriber hears the usual dial tone. He then presses pushbuttons which are exactly like the digits in a standard telephone dial. In sequence, he spells out the letters and numbers of the desired telephone number. The mobile transmitter sends out a unique tone signal for each pushbutton depressed, and the base station receives these signals and converts them to dial pulses which are applied to the dial exchange line.

The reverse procedure takes place for calls to the mobile units. The ringing from the exchange is converted by the Motorola radiotelephone terminal units into corresponding tone modulated radio signals which are transmitted to all mobiles by the radio base station. Only the desired party is alerted.

The mobile station control head has three lights, one indicating the channel is in use ("busy"); the second indicating the mobile station has been called (backing up the ringing signal), and the third indicating when the mobile station transmitter is on. When a mobile phone on the radio channel is being used, all others are locked out to insure privacy. Breaking into the line is possible, however, in case of emergency.

Reservation Mutual has signed a Motorola agreement for servicing the radiotelephone system. Through its Parshall Service Station, Motorola provides regular preventive maintenance and whatever emergency service is needed. The Motorola district service engineer provides back-up service.

Ahlgren reported subscribers are having no difficulty operating the mobile equipment. He says it is easier to use the pushbutton dial in a vehicle than to operate the conventional dial. Training the subscribers consists simply of showing them how to punch out desired numbers and teaching them the knack of "pushing to talk" and "releasing to listen".

The prestige of Reservation Mutual has been greatly increased, reports Ahlgren, due to the moderness of the Motorola equipment. North Dakota newspapers, magazines, radio stations and one international wire service have carried articles on the system, highlighting the progress it has brought to the area. » » »

TWO-WAY RADIO AIDS PENNSYLVANIA

Operating a high-volume logging company requires close scheduling of crews and frequent moves to new locations. Variable factors such as weather, type of timber in demand and accessibility have an effect on road building, cutting, skidding operations, and hauling. Any type of equipment breakdown can cause interruptions to the necessarily tight schedule.

These problems caused management of the Fisher & Young, Inc. mills in Titusville, Pennsylvania to install a modern Motorola two-way radio communications system in September, 1957. The results, according to Wilbert F. Young, president of the company, and William Nagy, Supervising Forester, are very satisfactory.

Here's how the logging company is using its system. The network consists of a 60-watt base station transmitter in Titusville and 10 mobile units. The mobile radio equipment is installed in Nagy's jeep, the road building crew's jeep, two log loaders, four of the eight log trucks, the fork lift at the mill yard and Young's car.

Major benefits of the system are closer scheduling of operations and reduced time lost to equipment breakdowns, resulting in increased log delivery production and improved over-all efficiency. The ability of management and supervisors to be kept informed of all operations at all times and to give direct instructions has eliminated in-between supervision and its inefficiencies.

Radio-equipped log trucks are spaced between those without radio, so that any truck can notify the mill of breakdown without too much delay. A driver with equipment difficulties inspects the vehicle, calls the mill garage via radio and talks directly to the mechanic. Oftentimes, the mechanic can instruct the driver how to make the repair temporarily so he can continue on his way.

Remote control console for base station is located in main office. Unit is connected by wire lines to hilltop transmitter.

If the difficulty is more serious, a repair truck is dispatched immediately so the equipment is put back in operation with a minimum of delay. Since equipment is extremely expensive when it stands idle, each minute saved through radio helps a great deal in cutting that cost.

When the breakdown can not be fixed in a short time, the driver catches the next truck back to the mill where he is assigned another vehicle to continue hauling.

During routine daily operation, the radio-equipped log loaders and trucks are informed of all location changes, eliminating "lost" trucks and wasted miles. The road building crew does not have to wait for a truck to take in a message that it needs particular equipment or supplies, such as a culvert or planking. Rather, it radios these requests to the mill and the supplies are loaded on the first returning truck. Each of these radio applications means a certain amount of time converted from waste to produc-

Advantages of 2-Way Radio Communications Listed by Fisher & Young, Inc.

- All equipment is coordinated, an important consideration, because of the widely-scattered logging activities.
- Management is kept fully informed of over-all operations.
- Equipment breakdowns can be reported immediately.
- With constant radio contact, construction crews can order equipment for immediate delivery if desired.
- Materials handling by mill yard fork truck is more closely controlled, thus eliminating wasted motion.
- Help can be called instantly during emergencies such as fires or accidents.

LOGGING OPERATIONS

tivity. Individually, this may seem relatively unimportant. But when added up over a week or month's logging, the total of gained productive time is quite impressive.

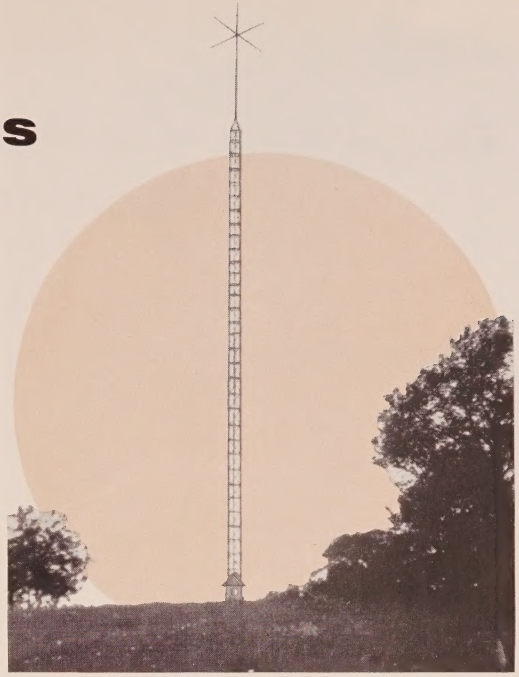
Even the unit on the mill yard fork truck is productive. This set was installed some time after the original system was put into operation. The fork truck covers a 15-acre mill lot. Its operator saves much time by being able to ask for and receive instructions as to lumber movement and storage as soon as he has need for them. Before radio, this man would have to make a special trip to the office for instructions.

While extreme emergencies, such as fire or accidents are uncommon, they do occur. In some cases, radio can pay for itself in one day since assistance can be called for in minutes.

The radio system is licensed on a low band frequency and Motorola "Private-Line" equipment is used. These units are designed to eliminate much of the co-channel messages and other interference present on a shared radio channel. The mobile units also have transistorized power supplies and speakers.

The base station transmitter is located near the mill on a hill, where Fisher & Young erected a 50-foot steel antenna tower. The transmitter is connected to the remote control units in the office and garage through leased telephone lines.

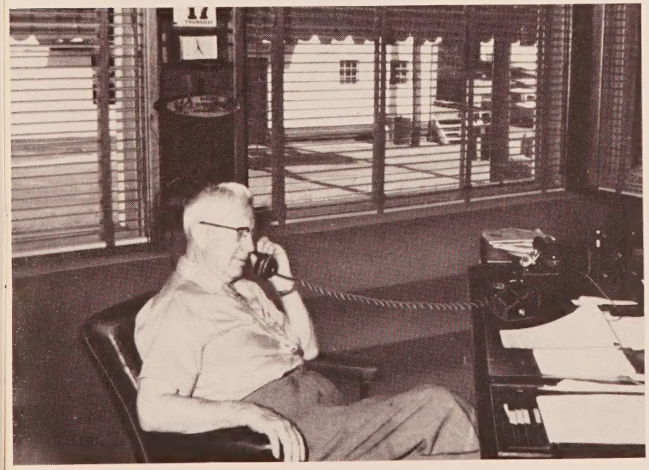
Normal operating range is about 25 miles, although 60 miles have been covered when the mobile units are located on hills. The mobile units, of course, can communicate between each other at somewhat reduced ranges. However, when too far apart to talk directly, mobile-to-mobile communications can be maintained by relaying through the base station.



Antenna for 2-way radio system is mounted on a 50-foot steel tower.

The entire radio system is being serviced through a maintenance agreement with Motorola. This provides for periodic preventive maintenance checks and emergency servicing, all under a set monthly rate. » » »

W. F. Young, president of Fisher and Young, can reach woods, mill yard and supervisors with 2-way radio desk set in his office.



William Nagy, Supervisor of Forestry for Fisher and Young, directs logging from his jeep via Motorola 2-way radio.

MOTOROLA TWO-WAY RADIO FOR MUNICIPALLY

At a time when many municipally-owned electric utility companies were dropping by the wayside because of financial difficulties and the larger public service companies were taking over, the town of Braintree, Massachusetts, not only kept its utility but actually found a means of enlarging its system.

Armed with a large bond issue and a vote of confidence from its citizens, Braintree began construction of a $500,000 generating plant designed to increase capacity by 50 percent. It is fully expected that expanded facilities will result in more efficient service at lower rates.

To further enhance its capabilities in the supply of electrical power, Braintree installed a Motorola 2-way radio system. According to Alban Spurrell, Manager of the Electric Department, "2-way radio communications provides a means of attaining greater efficiency and decreased operating costs that are just as noticeable in the smaller organizations as with the larger utilities who have been 2-way radio users for many years. Radio does a real job for us," Spurrell emphasizes.

Braintree Electric Department serves 8,400 accounts and has 53 employees. The town has a population of 29,000 and covers about 14 square miles. The plant is presently rated at 23,000 KW. In 60 of its 64 years in existence the department operated without 2-way radio. Then, the Motorola communications system was installed. "Now," says Spurrell, "no one could convince us to return to that radioless existence. The system has become a necessity for more efficient handling of both routine and emergency business."

The system operates on two frequencies, with the Motorola base station transmitting on 451.65 mc and receiving on 456.55 mc. The mobile units work just the opposite.

The base station is controlled from three Motorola remote control consoles at the plant. The station transmitter is located on a hill a mile from the plant. To avoid damage during storms, a rather unique line connection was set up. Heavy-duty steel messenger cable was strung between the power plant and the base station. A special armored cable containing four conductors—two for voice and two for power—was lashed to the cable. The power lines run directly from the town's 440 VAC station bus. A transformer that breaks the 440 down to regular 117 voltage for powering the radio is at the transmitter site.

Says Spurrell, "The arrangement may seem rather elaborate, but we feel that no matter what happens in our town

Line crews are kept in constant touch with headquarters through Motorola radio communications. Formerly, if a crew were needed, line foremen would have to search the area to find it. Radio contact has provided many advantages in saving time, mileage and increasing productivity.

WAY RADIO PAYS BIG DIVIDENDS OWNED ELECTRIC COMPANY

due to storm, our radio will stay in operation, since it has its own power source and control lines."

Motorola transistorized dynamic desk set microphones are used at the office control point. As the handset is lifted, the loudspeaker on the desk set is turned off and the message received through the handset. This eliminates disturbing employees and customers in the office with unapplicable radio conversation.

To complete the system, Motorola mobile units were installed in the department's three line trucks and one panel truck.

Spurrell lists the most important benefit of the two-way radio system as control of the smallest line truck. In the past, he said, they had to keep this truck at the shop three mornings a week for possible new service installations because the inspector's reports didn't come in until late morning. But with radio, the truck can be sent out on small jobs early and dispatched to any new service installation that may come up during the day.

A second benefit is finding crews when plans have been altered. Once a truck is sent out to perform five to ten jobs, it would be impossible to locate it immediately without the radio system. It overcomes the past requirement of going out in a car to look for the crew in case of necessity, Spurrell said.

With Motorola radio, the Electric Department is able to keep in constant contact with the one line truck it has on the night shift to patrol lines and handle preventive maintenance. In an emergency, this truck can be sent immediately to the critical spot.

When there is an emergency, Spurrell said, "radio becomes indispensable". By way of illustration, Braintree was hit by a serious flood shortly after the radio system was installed in 1955. Customers calling in from all parts of the town that their basements were flooded, we used radio to very good advantage to dispatch our crews to various danger points to turn off the electricity", Spurrell said. "Before radio, if an outage was reported, someone from the office would have to drive to the trouble spot to see what actually was the difficulty and then hunt up a crew to make necessary repairs", he added.

Spurrell calls radio an asset in achieving both good service and low rates, two "musts" for a municipally owned organization. "Through effective coordination and increased communication", he says, "service is greatly improved and yet costs are cut because of greater efficiency and productivity". » » »

Line foreman, Jack Moffett, utilizes Motorola remote-control console for Braintree, Mass. Electric Department's radio system. The base station can be controlled from three such consoles within the plant.

The control point facilitates communication with field crew on a switching detail, permits immediate reassignment if desired.

Exterior of Delta Implement Company headquarters at Greenville, Mississippi. Antenna on tower in background gives 2-way radio coverage of up to 30 miles.

RADIO CONTACT INCREASES SERVICE VOLUME BY 50%

"I really can't measure total benefits of my 2-way radio system", says F. H. (Slim) Holiman, manager of Delta Implement Company, Greenville, Miss., "but I know this much, I wouldn't want to work without it".

Holiman speaks with a year and a half experience with 2-way radio, a communications tool that is catching on as a boon to increase efficiency and productivity in many implement sales and service companies.

The system used by Delta Implement to cover the prime cotton, rice, and grain farm land around Greenville is typical of those used in the implement business. At the Greenville headquarters is a Motorola 60-watt base station and a 100-foot antenna tower. In eight of Delta's vehicles used by servicemen, salesmen and management are 30-watt Motorola mobile units. This system provides consistent 2-way radio coverage of about a 30-mile radius, reports Holiman.

Holiman's radio system includes a base station owned by Delta Implement and mobile units that are leased from Motorola. Knowing the importance of continuous equipment maintenance if one is to realize one's full investment, Holiman has contracted with Motorola for radio system service. The regular preventive maintenance program and whatever emergency service needed is performed under sub-contract by Motorola's service station in Greenville.

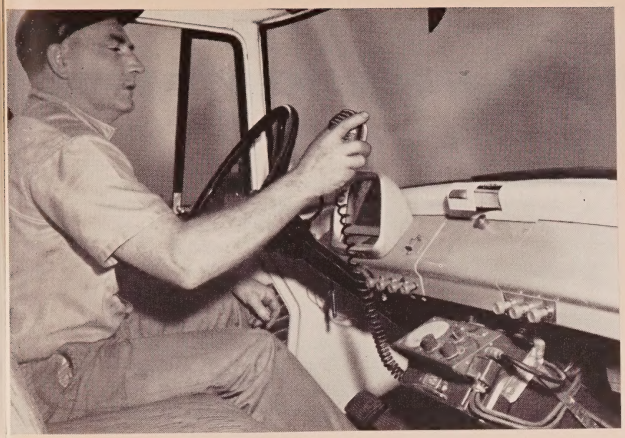
The big use for the radio system is by the service department, agrees Holiman and his service manager, Homer Poole. Its use is quite simple. A mechanic may be out 20 to 30 miles servicing some equipment. When finished he would drive back to Greenville. During the busy seasons, chances are that he would have to head out immediately on another call. If that call should be in the same general area as the first one, he would have wasted an entire trip—costing Delta Implement vehicle-operating expense and nonproductive mechanic's time, to say nothing of keeping customers waiting.

With radio, the entire situation is different. As the man finishes one call, he radios in and asks where his next stop will be. The nonproductive trip to and from Greenville is eliminated. Poole says that during the cotton picking season, he has three mechanics in the field at all times. They never return to the shop. The entire day is spent on service, not in driving.

He says that 2-way radio has increased his department's capability by 50 percent during the busy times of the year. When a mechanic arrives at a site, he finds out as soon as possible what is wrong with the machinery. Should new parts be needed, he can radio Greenville and ask that they be made ready. The farmer frequently makes the trip to town for the parts while the mechanic is tearing down the machinery. Not only is Delta Implement getting more done in a day's time, but the farmer gets better service. Since equipment sales depend on service, this is a most important radio benefit.

Delta Implement's delivery truck gets a heavy workout, and the radio in it makes certain there are as few wasted miles as possible. Any time the truck is away from town on a delivery, the firm's salesmen or sales manager can radio if they should need a trade-in picked up. Delta Implement's Greenville store is one of eight International Harvester dealerships in the Mississippi Delta area under control of the same company. Oftentimes the Greenville truck will have to pick up machinery at one of the other stores. Radio is used to dispatch the vehicle to that store when needed.

Management of any bustling business requires immediate information. For this reason Holiman is particularly attached to the 2-way radio system. He knows that he can be out in the territory and still be reached at any time, should he be needed at the store. » » »



① Delta Implement Company serviceman has completed a service call and checks in with headquarters.

② Office girl acknowledges radio message, indicates time and dispatches serviceman to another location in the vicinity.

③ Repairman proceeds to new assignment and finds cotton picker disabled and in need of a part not normally carried in the service truck.

④ Using Motorola Handset connected to office extension, service manager accepts call and informs serviceman part is on its way.

MOTOROLA RADIO-PAGING

The Illuminating Building, Cleveland's first new skyscraper office building in 30 years, is managed by the Ostendorf-Morris Company. A Motorola "Handie-Talkie" radio paging system provides communications to the management firm's personnel throughout the 22-story building. Inset, Motorola paging unit such as used in the Cleveland Illuminating Building.

Impossible to shrink a skyscraper? William Dunn, Vice President of Ostendorf-Morris Company does it every day. As head maintenance manager of the Cleveland Illuminating Building, Dunn is faced with the problem of servicing 22 stories and 420,000 square feet of glass-clad skyscraper with a minimum amount of personnel.

To provide the quality service demanded in a prestige office building of this caliber, Dunn has employed a Motorola radio paging system as modern as the skyscraper itself.

The Illuminating Building paging system consists of a central transmitter and ten individual, pocket-sized radio receivers worn by key maintenance and building personnel. Whenever one of these men is wanted for a special task, his number is dialed on the paging control telephone in the superintendent's office. This causes a tone to sound in the desired person's receiver, alerting him to the voice message that is then broadcast. Only the individual paged hears the tone and the voice message. All other paging receivers in the system remain quiet.

Radio paging is a rather recent development, but its inherent flexibility, privateness and reliability have caused its use in hundreds of hospitals, hotels, department stores, restaurants and industrial plants. These reasons, plus economy, caused the Ostendorf-Morris Company to choose it for the Illuminating Building.

Owned by 55 Public Square, Inc., the Illuminating Building houses such well known companies as Allis-Chalmers, Westinghouse, General Motors, IBM and Shell Oil, in addition to several consulates of foreign governments and many law firms. The Ostendorf-Morris firm is the managing agent for the building.

Routine preventive maintenance holds to a minimum the need for emergency service, but as any office building manager knows, the unexpected happens all too frequently. A light bulb fails, plumbing jams, the air conditioning isn't working just right.

As Dunn says, "The radio pagers lets us find the right man when we need him." Without it, hunting down the utility man, for example, in a 22 story building could be a hectic, time-consuming chase.

The pocket radio pagers are used during the day by the maid, the janitor, two air conditioning mechanics, the utility man, the lobby relief man and the Building Superintendent. When management personnel from the Osten-

Electrician wears his Motorola radio paging receiver on his belt. With this unit, he can be reached quickly, anywhere in the building.

EXPEDITES SKYSCRAPER MAINTENANCE

dorf-Morris Company office visit the building they pick up a radio pager so that they can be reached immediately.

The Night Supervisor combs the building each night, and makes up a check list of things that need attention. When the day maintenance crew arrives, it starts on the check list. If a tenant calls asking for a particular service, the appropriate man is radio-paged and told to take care of the situation immediately. Oftentimes, the complete message is sent over the radio paging system. If verification or two-way conversation is needed, the man is asked to call the building office on the nearest house telephone for full instructions.

Here's a few examples of the types of calls that are sent by radio:

Many tenants in the building are not used to the continuous air movement felt in a fully air-conditioned building. Consequently, the air conditioning men are paged quite often to take care of any complaint that "there's a draft". Solicitors or suspicious persons seen loitering in the building are reported to the building office. If the Building Superintendent isn't there, he is paged immediately. He can then go to the floor where the person was seen to escort him from the premises. The presence of several consulates in the building makes this service an important one.

A burned out or flickering fluorescent tube can be called to the utility man's attention at once through the radio paging system. This enables him to correct the problem before it becomes annoying to any tenant.

The paging system is also used at night. The Night Supervisor, Floor Lady, Assistant Floor Lady, and the watchmen-janitors all wear the receivers.

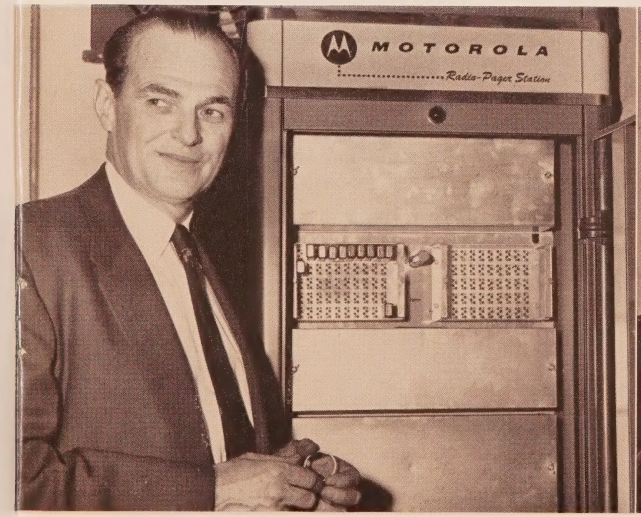
For convenience during night operations the control telephone can be taken from the building office and placed in the lobby, where a special line connects it to the transmitter.

The Motorola system uses a low-powered, low-frequency transmitter that does not require a Federal Communications Commission license. A special loop antenna is needed to radiate the signal throughout the building. Since the need for this system was envisioned during the planning of the building, installation of the loop antenna was simplified and its cost held to a minimum. The wire loop antenna was stretched about each floor before the ceiling was installed.

A regular public address system would cost about four times as much as radio paging and would be less effective, since desired personnel could be in portions of the building unreached by the public address. If designed to be loud enough to cover all corners of the building, the public address would be disturbing to the building's tenants.

The individual radio pagers operate on tiny mercury dry batteries which are easily replaced. Thus far, says Dunn, regular replacement of the batteries has been the only maintenance required for the system. The "Handie-Talkie" Radio Pagers are compact, transistorized receivers, weighing only 10 ounces, light enough to be worn in a pocket or clipped on a belt. » » »

L. T. McNeal, Superintendent of the Illuminating Building, stands beside the central radio paging transmitter that broadcasts tone signals and voice messages to individual paging receivers.



Control station for radio paging system is in managing agent's office. From this central point radio alerting provides maximum control of building maintenance activity.

THE ANSWER

On-the-spot inspection is given to one of KTA's patrol cars by General Communications Service. This panel truck is one of several radio-equipped service vehicles maintained by General Communications.

Like the many vast highway systems criss-crossing the United States, the Kansas Turnpike requires not only good road conditions, but also police protection, prompt administrative service and emergency provisions. All this must be accomplished over a four to six lane, 206-mile road stretching from Kansas City, Missouri, through Topeka and Wichita, Kansas, to the Oklahoma border.

These tasks require continuous, effective communications—often made difficult by the long distances covered. Initial system design is a one-time problem, often solved by effectively combining equipment such as microwave and mobile radio base stations with repeaters and control points. After a communications system is installed and in operation, however, the problem becomes one of maintenance.

Cost-conscious managers agree that a "fix-it-when-it-breaks" policy is not good if the full value of the system is to be realized. A comprehensive, preventive maintenance program must be followed.

To provide such maintenance and also emergency service to all mobile units and its 15 utility base stations, the Turnpike Authority entered into a Maintenance Agreement with Motorola. Under terms of this agreement, Motorola assumes responsibility for corrective and preventive maintenance of this system. Thus, the Turnpike Authority has only one source of maintenance to deal with—Motorola. Some of the advantages of this arrangement include:

- Relief from communications maintenance supervision
- Periodic inspection by Motorola service representatives
- Closely supervised preventive maintenance reduces outages to a minimum
- Motorola provides backup service to stations in event of emergencies.

In operation, the agreement provides servicing of the authority's units every 90 days, following a preventive maintenance routine. Each unit has its own file card for recording various readings. Transmitters are given frequency and modulation checks, re-alignment is made, if necessary, and the transmitter power output is measured. Receivers undergo complete meter checks, all key circuits are tested and receiver sensitivity is verified. The vehicle's electrical system is checked and each radio unit is given a complete mechanical test for loose parts, burned-out bulbs, and other possible sources of trouble. All present weaknesses and possible future malfunctions receive strict corrective attention.

Maintenance of 44 of the mobile units and six AC utility base stations in the system has been subcontracted to General Communications Service Company, the Motorola Service Station in Wichita. The 44 other mobiles are maintained by Mobile Communications Service, the authorized Motorola Service Station in Topeka. Assignments are made geographically, with all equipment north of Emporia, Kansas, going to Topeka.

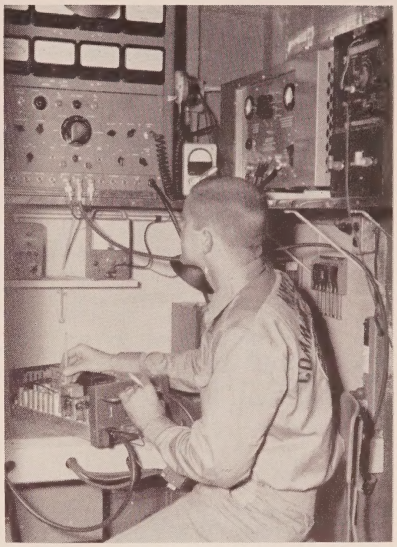
Immediate backup for these activities is provided by the Motorola District Service Manager and the Motorola District Service Representative. In addition, personnel at the Motorola Midwest Service Area office are available in emergencies.

Both the Wichita and Topeka service stations carry an extensive supply of parts and equipment relative to 2-way radio servicing under perpetual inventory, immediately available for both routine and emergency needs. Should unforeseen requirements occur, a quick call to the Midwest Area Parts Depot in Chicago would supply what is needed within the shortest possible time. The Depot maintains a 24-hour, every-day service for such instances.

As a part of this contracted service program, Motorola maintains service schools designed to keep technicians abreast with the most modern developments in the servicing field. » » »

TO TURNPIKE 2-WAY RADIO MAINTENANCE

General Communications' mobile, radio-equipped service truck is a 2-way radio laboratory on wheels. A complete complement of Motorola-recommended testing and maintenance equipment is carried for emergency field service.



Technician at Mobile Communications Service Station uses modern screen room to repair unit in intermittent condition. Simultaneous metering is used to check all circuits of both transmitter and receiver.

One of the owners of Mobile Communications Company discusses entries in a service call sheet with a Motorola District Service Manager.

Mobile Communications Company at Topeka, Kansas. In the foreground is one of the radio-equipped service vehicles used to provide fast customer service in the field.

Exterior view of General Communications Service Company's "drive-in" facility at Wichita, Kansas. General Communications maintains a large field force for both routine and emergency service.

GETTING THE MOST FROM YOUR TWO-WAY RADIO NETWORK

Article II of a series on maintenance and trouble-shooting.

Article I covered the importance of on-frequency operation and proper transmitter deviation. Two other important factors, receiver sensitivity and noise suppression, are covered in this article.

Receiver Sensitivity

Receiver sensitivity is commonly expressed in terms of the signal strength required to produce 20 db of noise quieting. The figure of 20 db is used as a radio industry standard (EIA) for comparison purposes and is generally accepted as a desirable noise reduction for good audio reception.

To measure receiver sensitivity, we inject an unmodulated signal into the receiver and increase the strength of the signal until there is a drop of 20 db in the noise level at the speaker. This requires the use of a signal generator, such as Motorola model T1034A, which has a calibrated output control that gives the signal strength for any given control setting. Thus, a sensitivity rating of 1 microvolt means that a 1 microvolt signal reduces noise by 20 db and would provide adequate audio for good communication. A 2 microvolt sensitivity is less desirable, since the receiver requires stronger signals for adequate audio output.

Receiver sensitivity is a good indication of a receiver's ability to detect signals. In general, the lower the microvolt sensitivity, the better the performance. Keeping the receiver sensitivity at or near the guaranteed specifications level is good maintenance practice and should be part of the radio maintenance program.

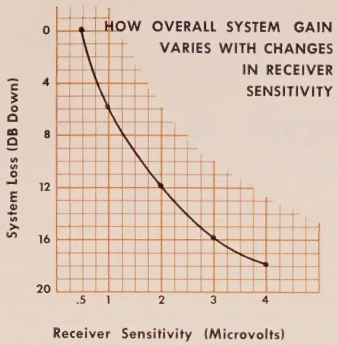
The curve plotted in the accompanying diagram shows how system gain varies with changes in receiver sensitivity. The figure of 0.5 microvolts is used as a reference point and is plotted as the zero db level for convenience in reading the chart. This drawing illustrates the importance of the "reserve" built into the Motorola receiver. As tubes age, sensitivity tends to decline. In Motorola design, additional amplification and very conservative tube ratings are used to minimize the effects of tube aging. This keeps sensitivity high and maintains system performance up to the design level.

From the standpoint of overall system performance, the factor of receiver sensitivity is coupled with another important characteristic of radio operation called the "ambient noise level".

Ambient Noise

Ambient noise is an inherent characteristic in all radio operations. It is measured in terms of microvolts of noise, the same as received signals are measured in microvolts of signal strength. For good radio communication, the signal at the receiver must be greater than the ambient noise. Where the ambient noise level overrides the signal level, the signals will not be readable regardless of receiver sensitivity.

Thus, it can be seen that the factors of receiver sensitivity, ambient noise



level and signal level are all interrelated. To get the most out of a two-way radio system these factors must be considered together. Notice that ambient noise and signal level will vary from place to place throughout the operating area of a radio network. Receiver sensitivity, on the other hand, is independent of geography but does vary somewhat from receiver to receiver and varies with time in any given receiver.

Ambient noise is caused by a wide variety of sources, both natural and man-made. These sources include the electrical system of the vehicle, rf radiated by other transmitters, power lines, electric signs, diathermy machines, etc. Ambient noise can be controlled to some extent where it originated within the vehicle. Motorola service manuals include many suggestions for suppressing noise caused by the generator, ignition system, electrical gauges, etc. Where the noise level is high due to these sources, a noise suppression program may be of great benefit in getting more out of the system.

Ambient noise levels due to other sources will generally be high in cities and low in rural areas. Thus, in getting the most out of a radio network it is desirable to have measurements of ambient noise levels at various typical points throughout the operating area. Generally speaking, if the ambient noise is particularly high throughout the entire area, an increase in signal level will be required to override the noise. Usually, however, an operating area includes points of high noise level and points of low noise level. In the typical radio system the ambient noise level is low enough over a wide enough area to justify full attention to keeping receiver sensitivity near the specified value.

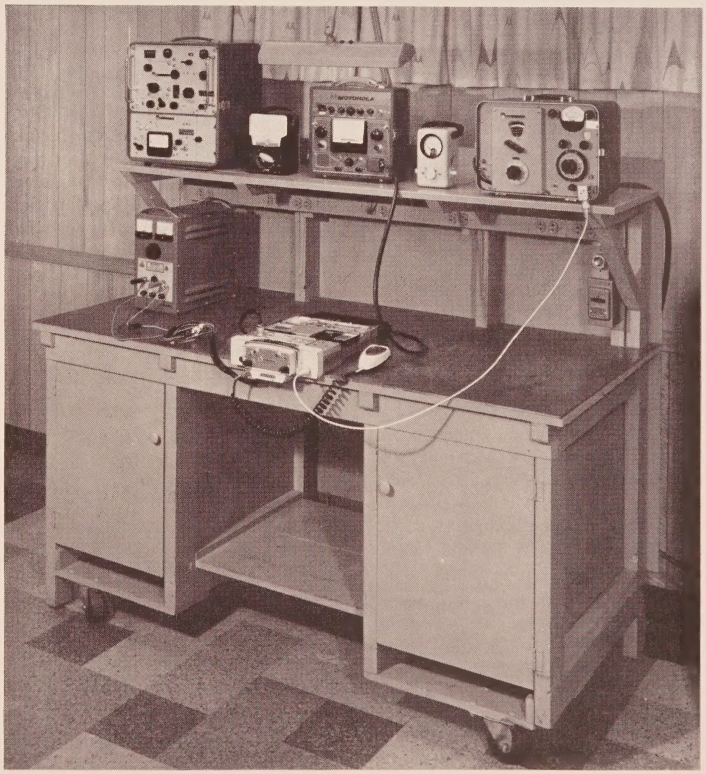
Checking Receiver Sensitivity

Motorola service manuals include full details for checking the 20 db quieting sensitivity of the receiver. These checks should be made and recorded periodically. Where the value is below the rated sensitivity the receiver should be worked on to bring the sensitivity back to an acceptable value.

Loss of receiver sensitivity can generally be traced to low gain in the rf and first if stages. This is usually due to tube aging, since the tuned circuits are very stable. Most often, a change of tubes in these stages will bring sensitivity back to normal. Tubes should not be changed arbitrarily, however, only when the change shows a definite improvement in operation.

If a change of tubes does not improve sensitivity, re-align the receiver as described in the service manual. If this does not provide acceptable sensitivity, then there is evidently a component failure in some circuit. Check plate voltages and power supply output and replace components as necessary to bring voltages up to normal. Check stage gain measurements in the rf and if stages. Compare these measurements with the chart in the manual to isolate the faulty stage. Within this particular stage, check voltage and resistance measurements to locate the defective component.

With proper attention to "netting" and deviation, as covered in Article I of this series, and the topics discussed in this article, you are well on your way toward getting the most out of your two-way radio system. Incidentally, if you want an "arm-chair" way to care for these matters, contact your local Motorola representative about a guaranteed maintenance contract. Under this contract, Motorola assumes full responsibility for top performance of your system. » » »



SERVICE HINTS AND SHOP NOTES

Changing Frequency? Check Your Antenna

Here is a tip which should prove very useful when changing operating frequency—*always check the antenna to make sure that it will operate efficiently at the new frequency*.

When changing frequency within the same band, (such as within the high band) the technician understands the changes required in the transmitter and receiver, such as crystal replacement and re-tuning. However, just as the transmitter and receiver must be tuned to accept one frequency and reject all others, so must the antenna, which is in itself a tuned circuit, be such that the new operating frequency falls within the frequency band of the antenna.

Remember, an antenna can: (1) deliver the RF power output your transmitter is designed for and (2) by using a gain antenna can actually add to the RF power output and increase your talk-back range. However, with an improper antenna and/or improper matching your radiated RF power output can be reduced, seriously impairing the radio coverage of your system.

Considering the many types of base station and mobile antennas in use, it is important to first note whether the present antenna can be tuned to the new operating frequency or whether it is a sealed, fixed-tuned antenna. All fixed-tuned antennas should be returned to the manufacturer for exact re-tuning. In cases where the antenna cannot be re-tuned to operate at the new frequency, a new antenna will be required.

This is the same for multi-element base station antennas, such as the corner reflector, isoplane and unipole. For these antennas it is not sufficient to merely cut the driven element to the proper length because the important factors of phase relationship and proper radiation pattern must be considered. This can be properly accomplished only by the antenna manufacturer. The manufacturer can re-tune the antenna, providing the new frequency is *higher* than the old frequency (higher frequencies use shorter elements, so they can be cut to size; lower frequencies require longer elements).

Mobile whip and roof-top antennas are considerably simpler in construction than base station antennas. These antennas can easily be modified to operate at the new frequency, provided the new frequency is *higher* than the old. If this is the case, an antenna rod cutting chart should be obtained from the manufacturer before attempting to shorten the rod for operation at the new frequency.

For high band operation the roof-top antennas are supplied in three pre-cut rod lengths, each covering a portion of the band. Therefore, when changing frequency within the high band and the new frequency falls outside the limits of the present antenna, a new rod should be ordered specifying the new operating frequency. » » »

Improving Oscillator Output in a Portable Test Set

The Motorola TU546 Series Portable Test Set has many built-in features to aid the serviceman and simplify the procedures essential to tuning and checking 2-way radio equipment. One of the many functions built into the portable test set is the transistorized crystal oscillator circuit, either 455 kc or, at the flip of a switch, two other outputs determined by the frequency of the crystals plugged into the sockets. The output from this circuit is used for alignment purposes pertaining to the receiver discriminator and the last IF stage. A relative indication of this output may be read on the test set meter with the position selector switch rotated to the RF position. Checking the crystal activity at periodic intervals by this simple method will assure adequate output is available when required.

If the output in any TU546 series Portable Test Set shipped prior to November 1958, indicates an appreciable decrease, try making the following changes in the crystal oscillator circuit instead of immediately replacing the crystal.

The changes involve an increased capacitance and an increased inductance in the oscillator feedback circuit to improve operation at lower frequencies through correct impedance and phase relationship in the feedback path. These changes are:

(1) Replace C10, a 30 uuf capacitor, with a 47 uuf capacitor (part number 21R122822).

(2) Replace L1, a 4.3 mh choke, with a 6.0 mh choke (part number 24K483466).

C10 and L1 are reference symbols used in the crystal oscillator portion of the schematic diagram in the portable test set instruction manual.

The 47 uuf capacitor and the 6.0 mh choke are available from any Motorola Parts and Service Depot under the part numbers indicated in (1) and (2) above. » » »

Increasing Dynamotor Reliability

Here is a tip to increase the life and reliability of your radio sets equipped with a dynamotor in the power supply.

Check the output circuit of the dynamotor to see whether there is a shunt arrangement between the high B+ output and the B— line. This usually consists of a single capacitor (Figure 1(a)) or a capacitor-resistor circuit

DYNAMOTOR POWER SUPPLY
Showing Specific Components Only
(Capacitor Shunt
Present Production Models)

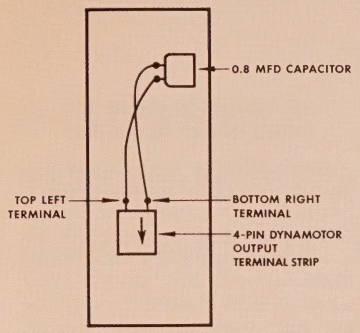


Figure 1(a)

(Figure 1(b)) configuration. It serves as a protection device for the dynamotor by damping the high voltage surge that occurs during the period immediately following the release of the microphone push-to-talk button.

All present production models of Motorola dynamotor power supplies have this built-in protection for added reliability and longer service.

If your dynamotor power supply is connected differently, a very simple change in the dynamotor output circuit can add this additional protection to any Motorola dynamotor power supply. In earlier model dynamotor power supplies such as TU583, a 0.8 uf capacitor is located between the high B+ line from the dynamotor and ground. All that is required to make the modification is to remove the capacitor from ground and connect it to the terminal strip lug on the B— side of the dynamotor output circuit. Make the modification as shown in Figure 1(a) if your power supply has a 4-pin dynamotor output terminal strip; Figure 1(c) if your power supply has a 2-pin dynamotor output terminal strip. This capacitor now shunts the dynamotor output circuit at all times for filtering purposes and protects it from high voltage surges if the dynamotor B— line is broken which would remove the dynamotor load. » » »

DYNAMOTOR POWER SUPPLY
Showing Specific Components Only
(Capacitor-Resistor Shunt
Present Production Models)

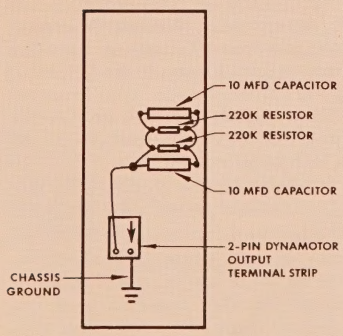


Figure 1(b)

DYNAMOTOR POWER SUPPLY
Showing Specific Components Only
(After Modification)

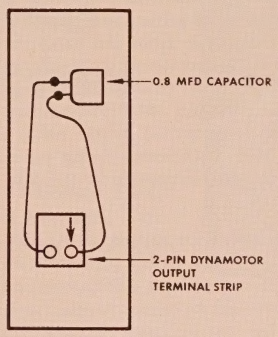


Figure 1(c)

Extending Service Life of Remote Control Console Transmit Relay

Motorola has introduced an improved circuit in its newer remote control consoles to increase the operational efficiency and extend the life of the transmit relay (K1). The improvement may be added to the earlier versions (TA270 Series) of the console to take advantage of this feature incorporated in the newer models (T1200 Series) of the remote control console.

The only component required is a 100 ohm, ½ watt, ±10% resistor. If this common resistor is not readily at hand it may be ordered from any Motorola Parts and Service Depot under part number 6R6326.

The purpose of adding the resistor is to provide additional high B+ surge protection when the transmit relay is actuated. This is a simple addition which adds to the overall reliability of the remote control console.

Make the modification as follows: (1) Remove the WHT-ORG lead from terminal #7 on the 40-pin terminal board on the front of the Power Supply & Amplifier Chassis. (2) Connect one end of the 100 ohm resistor to the WHT-ORG lead and the other end of the resistor to terminal #7 on the 40-pin terminal board. » » »

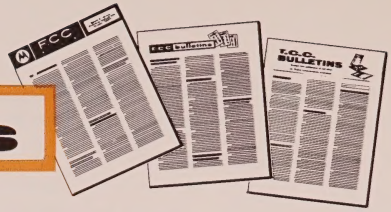
Buying Replacement Parts

Here is a valuable tip that will add to the quality of your servicing work and keep your equipment operating at peak performance for a longer time—*keep your replacement parts inventory stocked with "communications quality" parts from your nearest Motorola Parts and Service Depot.*

A typical example of how this can be of particular value is the case of the 4X250B tube used in Motorola 450 mc, 250 watt base stations. A certain manufacturer's 1957 production of these tubes falls below the standards required by Motorola, resulting in decreased performance characteristics and reduced operational reliability. Therefore, only 4X250B tubes manufactured after that date and those meeting Motorola specifications are used in original equipment and for replacement parts.

Every shipment of parts received by Motorola, whether for sale as replacement parts or for original equipment use, is thoroughly processed through the Incoming Inspection Department. The numerous tests required spell the difference between "communications replacement" parts and standard parts. Motorola selects only the items which pass the necessary tests and meet the specifications requirements. These high standards of quality control are your assurance of receiving the highest quality communication parts. » » »

FCC bulletins



Proposal for Automatic Mobile Repeater Operation

In a proposed amendment to its Railroad Radio Service Rules, the FCC asked comments on a plan to provide for the authorization of a mobile station to act as an automatic mobile repeater for the direct retransmission of the signals of low-power hand-carried or pack-carried transmitters, in order to extend the range of portable-to-mobile or portable-to-base communications beyond that normally possible by the smaller units.

The amendment would provide that, when specifically authorized by the FCC, a railroad mobile radio station may be used for the automatic retransmission, on its normal operating frequency, of the signals of the hand-carried or pack-carried units operating on other frequencies.

The Commission explained that a need for the rule amendment appears to have developed in connection with the use of the newer miniaturized models of low-power hand-carried two-way radio units in conjunction with conventional vehicle-mounted mobile units in areas which are comparatively far removed from the base stations of the mobile radio systems.

Specifically, the agency said, it appears that the operator of a vehicular mobile station may find it necessary to proceed on foot to a location which is inaccessible to the vehicle, and to communciate with other mobile units or with the base station of the system from such points using the hand-carried or pack-carried units, and in such cases the miniaturized equipment, while capable of receiving the signals of the associated base station and vehicular mobile units; may be unable to reply to such transmissions without the use of a relay of some kind.

In a case where no operator remains in the vehicle, the Commission said, it appears the vehicular radio unit must be capable of automatic retransmission of the signals from the hand-carried unit if the operator of the smaller set is to be able to consistently remain in communication with the base station or other conventional mobile units, and the rule amendments being provided are intended to provide for that kind of operation.

Proposed conditions would subject the use of the mobile repeater stations to the requirement that harmful interference not be caused to other stations by the hand-carried or pack-carried units; would provide that the mobile repeaters retransmit only the signals of hand-carried or pack-carried units operating above 150 megacycle and with plate input power not exceeding three watts; and would provide that the mobile repeater station be designed so that except when manually operated as a conventional mobile station, it will be activated only by means of a coded signal or such other means as will effectively prevent its activation by undesired stations.

Except when manually operated as a conventional mobile station, the repeater must also be deactivated upon cessation of the coded signal, cessation of other selective activation means, and, in addition, must be provided with automatic time-delay or other device which will deactivate the station not more than three minutes after its activation. Under the proposal, the mobile repeaters would be authorized to operate on any mobile service frequency available to the service.

The proposal would also remove the existing "developmental" limitation on the operation of railroad mobile relay stations, the Commission said, "since that limitation no longer appears necessary". » » »

Positive Statement of "No Users" Required

Applications for "split channel" frequencies in the public safety radio services before November 1, 1963, in the 25-50 and 152-162 megacycle frequency bands, under new requirements instituted by the FCC, should include a positive statement that the applicant has either obtained written consent from all licensees authorized to operate within 75 miles on frequencies within 30 kilocycles (including co-channel users) of the requested frequency, or that "there are no users authorized to operate within 75 miles on frequencies within 30 kc (including co-channel users) of the proposed station."

The new requirement is intended to dispel any ambiguity which might otherwise arise from an applicant's statement that he has examined a record source, and, according to that source, there appear to be no users within 75 miles and 30 kc. It is the position of the FCC, it is understood, that the applicant has the firm responsibility of assuring the Commission that "there are no users" within 75 miles and 30 kc, or if there are, that the written consent of all of them has been obtained. » » »

Proposal to Eliminate Base, Fixed Operator License Requirement

A proposal to eliminate the present rule requirement that persons operating base or fixed stations in the Industrial, Land Transportation and Domestic Public Services have operator licenses from the FCC was released by the Commission recently.

The amendment would provide that an unlicensed person, after being authorized by the station licensee to do so, may operate a base or fixed station, during the course of normal rendition of service when transmitting on frequencies above 30 mc in the three services involved. » » »

NEW products

PORTABLE FREQUENCY AND DEVIATION METER

The new Motorola Portable Frequency and Deviation Meter combines maximum accuracy, stability and versatility with compactness and light weight that makes it as readily adaptable for field use as for the service shop.

The new Portable Frequency and Deviation Meter is an outstanding addition to the Motorola line of quality test equipment. It is designed specifically for the exacting requirements of communications equipment servicing.

This precision instrument is basically two meters in one—a highly accurate frequency generating and frequency measuring meter, and an accurate peak - reading modulation deviation meter. It is a precision built instrument which exceds all FCC requirements for split-channel measurements.

Primary uses for the meter are: (1) measure frequencies, (2) generate frequencies, (3) calibrate other variable frequency devices, and (4) measure transmitter modulation deviation.

Measuring and generating frequencies by this one instrument provides a fast, highly accurate means of "netting". With one setting of the dials the transmitter and receiver can be placed on frequency.

Despite its extreme accuracy as a precision test instrument, the meter is designed for one-hand carry when field use is required. It is protected by a sturdily constructed metal housing. A metal front cover protects the dials and knobs, and is removable as required for use. A handle at the top of the housing provides a convenient means of carrying the instrument.

Power requirements are 115 volts, a-c, 50-60 cps.

Frequency Meter

The frequency meter has a fundamental range of 20-40 mc. It is a harmonic device which uses the fundamental frequency and harmonics of the fundamental to measure and generate frequencies from 20-1000 mc. Frequencies below 20 mc can also be measured. For example, a 5 mc input signal may be measured by using its fourth harmonic. Unknown frequencies can also be measured.

The basic accuracy of the meter is determined by a precise, 1 mc, oven-heated crystal. The frequency as read directly from the meter is maintained to an accuracy of $\pm 0.0002\%$; where greater accuracy is desired, frequency may be determined within $\pm 0.0001\%$ by use of a calibration chart supplied with each meter. Use of the calibration chart provides an accuracy which is five times that required by the FCC for frequency tolerances.

The 1 mc crystal, in addition to maintaining overall stability of the frequency meter, provides a crystal oscillator output which is available at the front panel for use as a secondary frequency standard. This 1 mc output maintains the same exacting frequency tolerances as the 1 mc control crystal.

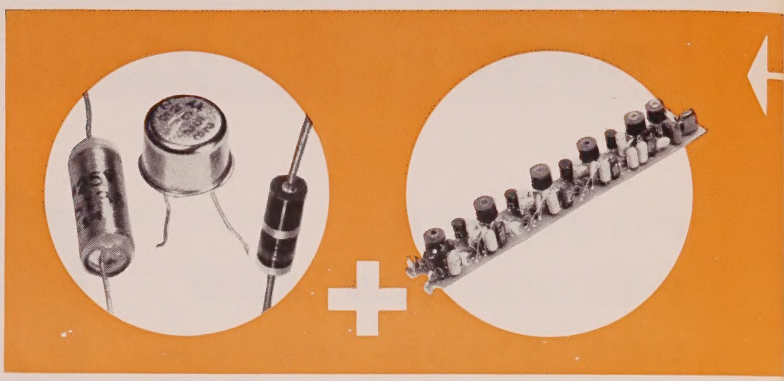
On AM a fixed 1000 cps, 30% modulated signal is provided. The FM deviation provided is variable to 1 kc maximum over the fundamental range of 20-40 mc. The amount of deviation available in other bands is a function of the harmonic used; for example, 5 kc maximum deviation at 150 mc and 15 kc maximum at 450 mc.

The crystal frequency can be standardized against WWV very simply without removal from the case.

Modulation Deviation Meter

The modulation deviation meter is a dual-range, peak-reading meter which measures transmitter deviation at 7.5 kc full scale or 15 kc full scale. Frequency range is 20-1000 mc with an accuracy of $\pm 5\%$ of full scale. » » »

PLANNING PRODUCT RELIABILITY



QUALITY COMPONENTS PLUS IMPROVED COMPONENT LAYOUT

Space Age . . . Atomic Age . . . Technological Age . . . these are familiar phrases signifying modern day technological advancements in numerous fields of endeavor. Important discoveries and progressive developments are responsible for rapidly increasing scientific achievements in such fields as complex military applications and transportation as well as new and advanced communications equipment. Accomplishments such as these are the result of extensive planning, designing, experimenting, testing, and numerous intangibles—not the least of which is obtaining the engineering talent so essential to progress. Every technological advancement, whether large or small, must ultimately be judged by its *continuing* usefulness in application. Continued high level performance involves the concept of reliability engineering, the basic detailed and continuous follow-through efforts to reach the zenith in design—perfection.

Reliability can be defined in many ways, mostly highly technical, in terms of statistics and probabilities . . . but to the purchaser and user of equipment, the important factor is always, "how long can I realize maximum equipment performance with minimum maintenance?" If the design engineer ever adopted a motto, "maximum performance with minimum maintenance" would very well summarize his philosophy.

Reliability can be separated into two distinct fields of study: the *design* of components and the *application* of components.

Usually, it is the finished product only that is seen by the ultimate user of the equipment or system. But the consistent development of better equipment and systems is not possible unless equally aggressive attention is given to developing the ever-increasing number of components of which they are comprised. This is the responsibility of the scientists and engineers working in the field of components design. They must anticipate the equipment design engineer by several years to give him the tools he needs to put his equipment ideas into effect.

The logical approach to product reliability is to begin with the components which comprise it. To re-phrase an old familiar axiom: "an electronic product is only as reliable as its weakest component."

This article deals mainly with component reliability and some accepted methods of achieving this end. Many of these methods are the results of Motorola's exhaustive efforts to achieve the ultimate in quality. System reliability will be covered in another article designed to show how careful systematized component reliability planning is of major importance in determining reliability of complete integrated systems.

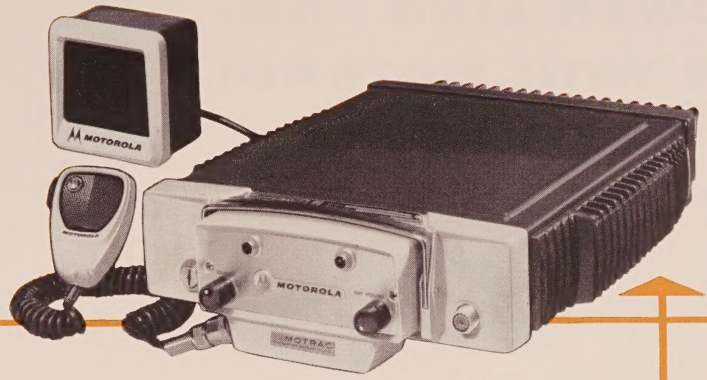
Where Does Reliability Begin?

Reliabilty begins with the basic component, i.e., the transistor, resistor, capacitor, etc. Unlike mechanical components which usually are made of the same type material throughout, most electronic components consists of several types of materials. This immediately presents the problem of interaaction between materials when subjected to various conditions of use. When conditions such as these exist, as they certainly do in electronic equipment, something must be done to assure that the basic components will perform as required when integrated into the electronic circuit. This then requires a comprehensive inspection and testing program.

When Is A Component Reliable?

Determining reliability requires investigation of two very important factors, namely, the actual conditions of use which present many variations and, the difficulty of manufacturing components within the tolerances required. Another important factor to consider is that when a shipment is received from a certain supplier and this group of components is evaluated it does not necessarily mean the *next* shipment of the same type components will have identical characteristics to the first. Component characteristics can vary from shipment to shipment. There should never be occasions when "time is of the essence" when a shipment could be placed in stock without inspection simply because all previous shipments from the same supplier have been accepted. This practice can very seriously endanger the entire reliability program.

To determine reliability of compon-



YIELDS **HIGHLY RELIABLE EQUIPMENT**

ents a large number of factors must be considered. All information obtained from the various testing and inspection sections must be accumulated, analyzed and verified.

In the final analysis, the reliability of a component is known by its performance under actual conditions of use. For this reason it is important that the dynamic limits of parameters and stresses be considered instead of average values or ratings which vary due to component characteristics.

Data Evaluation

Highly important in the program of reliability improvement is the evaluation of data received from various sources.

Reliability determination of a particular component depends upon the reliability of the source of the data. To avoid possible errors, the data should be tabulated at the time the defect is discovered. A long range continuous plan for maintaining reliability requires enginering knowledge and supervision throughout all phases. The engineer is primarily interested in the nature of the defect while all other phases of the reliability program are concerned mainly with the number of defects.

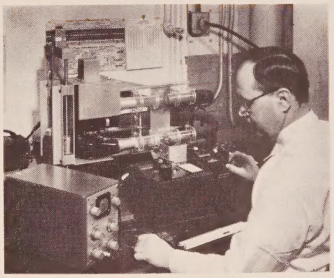
Several sources where data can be obtained are:

1. From the manufacturer as a result of in-process data obtained during the manufacturing process.
2. Incoming inspection department. Inspection report results as determined from the components tested and checked.
3. Production engineering department. Supplies information concerning defects or difficulties encountered in meeting specifications.

Data obtained from these sources will relate all factors concerning a component, such as variations in tolerances and behavior under test, frequent failure, obvious defects in workmanship and defects in construction of the particular component.

To determine the causes of some of the defects may require considerable time and expense. The defective part should be returned to the supplier for a complete analysis of the problem. To allow the supplier to perform comprehensive tests and analyses, the condition of use and a schematic diagram showing where the component will be used should be sent with the defective component.

There may be isolated instances where local efforts are made to improve a deficiency. Corrective action based on routine information is never very effectice and may only be temporary. All corrective action should be based on tabulated results of the comprehensive tests and analyses.



This highly sensitive and extremely accurate temperature coefficient capacitor checker assures that only components well within limits will be used.

The entire reliability improvement program must be maintained by continuing high level efforts and coordination, starting with the raw material throughout the entire manufacturing process to the completed product.

Reliability improvement should always be sustained by the idea of perfection. Plans and objectives for further perfection should be made known to all involved in the reliability program —the design engineer, research and development, production and the suppliers. » » »

A second article in the RELIABILITY series, "System Reliability," will appear on these pages in a future issue of the NEWSGRAM.

NEW POWER LINE PROTECTION WITH MOTOROLA MC-20 MULTIPLEX EQUIPMENT

Model MC-22 Transistorized Transmitter (top) and Receiver (bottom).

Model MC-22 Baseband Relaying Multiplier Assemblies Mounted in Standard 7-foot Rack.

Complex electrical utility distribution networks are usually designed to be supplied by several power generation stations simultaneously. Such networks are safeguarded by circuit breakers which are designed to trip in case of a fault (short-circuit) between phases, or between any phase and ground. When such complex networks or power grids depend upon the independent operation of circuit breakers, it is possible for large sections of the distribution network to be cut off from a power source or sources, or it is possible that a generation station may be isolated from the line with resultant overloading of the remaining power generation equipment.

Transferred-Trip Protective Relaying

Efficient safeguarding of the power distribution network without such loss of efficiency may be obtained with the installation of a microwave system equipped with Motorola MC-22 transistorized Multiplex equipment. When a line unbalance (indicating a fault) is detected at a feeder point, substation, or other location, selected circuit breakers throughout the system or the line section may be caused to open simultaneously, *or* a permissive trip signal may be transmitted which will cause the proper one of two circuit breakers to open in order to disrupt service as little as possible. Rapid reclosing of the circuit breakers once a temporary fault has cleared is equally possible and, with the aid of the MC-22 Multiplex Equipment, the necessary contact closure will be transmitted to all necessary circuit breakers within the time occupied by a few cycles of power line current.

Protective Relaying Problems Simplified

Many of the protective relaying problems associated with multi-terminal lines — and with transformers which are part of a line—are simplified by transferred-trip protective relaying. Substantial savings may be produced in multi-terminal design by the elimination of expensive circuit-breaker installations. Transferred-trip is particularly advantageous in multi-terminal line sections, since it is often difficult or impossible for the protective relay at each terminal to detect faults in all parts of the line section. A relaying channel can, in the latter case, transfer the tripping information from a protective relay (at another terminal) which *can* detect the fault. This "transferred-trip" method results in much faster opening (and re-closing) of *all* breakers than is possible with a sequential trip method.

Failure of primary relaying to respond immediately jeopardizes system stability. With a fast, reliable and secure relaying channel, transferred-trip qualifies as the primary method of protection in many cases.

Security, Speed, Reliability

Transferred-trip protective relaying may be accomplished by several methods. These methods vary widely as to speed of operation, security against false operation, reliability, maximum number of terminals per section, and maximum operating distance. However, the most important considerations in designing any transferred-trip system are:

security—the assurance of operation only when an internal fault exists

speed—rapidity in determining an internal fault and the speed with which all circuit breakers in a section are tripped

reliability—the assurance of operation whenever an internal fault exists

Since a transferred-trip system can not be faster, more reliable, or more secure than the relaying channel that is used, Motorola MC-22 Relaying Multiplex Equipment has been specifically designed to transfer tripping information over a baseband of subcarrier frequencies which modulate a microwave carrier; thus, it provides a relaying method possessing optimum reliability, speed, and security.

The Microwave Transmission Medium

The requirement for relay channels may be initially large and will probably increase with future expansion; therefore, the channel capacity of the transmission medium is important. Forty-one channels may be applied to one microwave baseband and, if the Motorola MR-20 Microwave Equipment and MC-20 Multiplex system are in use, an additional 48 channels of quality voice communications will be available with no mutual interference. The Motorola Microwave system, in addition to being extremely reliable, is immune to the usual transmission line troubles. Microwave spans rivers, swamps, and mountains with relative ease and is not subject to power line faults and inclement weather. Flexibility is another important characteristic of microwave systems, a quality emphasized not only by the large available channel capacity but by the fact that a microwave stub may be installed to easily reach a circuit breaker remote to the main line of communication. For these reasons, MC-22 Relaying Multiplex Equipment has been designed to be used with microwave as the transmission medium.

Transistorized Circuitry Throughout

Both the Transmitter and Receiver of the MC-22 Relaying Multiplex are completely transistorized, a feature which contributes not only to miniaturization of the equipment but greatly increases the reliability of the equipment. The failure rate of transistors in comparison with that of vacuum tubes is phenomenally low. In addition, the low power consumption of transistors and consequent low heat dissipation permit cooler operating of equipment without the necessity of forced ventilation. Each transmitter and receiver of the MC-22 Multiplex system occupies very little room, either assembly being only one rack unit (1¾″) in height.

Signalling Achieved by Frequency-Shift Keying

The Motorola MC-22 Baseband Relaying Multiplex operates in the frequency band of 40 to 200 kc with 4 kc channel spacing between center frequencies, and is particularly designed for application directly to a microwave base band without any intervening equipment. A contact closure fed into the transmitter shifts the transmitter frequency from 500 cps above center frequency to 500 cps below. The contact closure is recovered at the remote station by the baseband Relaying Multiplex Receiver. This receiver is fed from the video output of the Microwave Receiver.

Drift-free Oscillators

Frequency stability of the Transmitter oscillator and of the local oscillator of the Receiver is assured by the unique circuitry and quality components used. In the transmitter, the carrier frequency is generated as the difference frequency of two crystal-controlled oscillators — one operating at 4 mc and the other at 4 mc plus the carrier frequency. The latter oscillator is the modulated oscillator, and is caused to shift from 500 cps above center frequency to 500 cps below when keyed by an external contact closure. The carrier frequency will shift in like manner as the modulated oscillator is keyed.

The local oscillator of the MC-22 Multiplex Receiver is similar to the Transmiter oscillator in that two crystals are used. As in the Transmitter, one of the crystal-controlled oscillators operates at 4 mc, but the other oscillator operates at 4.012 mc plus the carrier frequency. Thus, the mixer stage of the Receiver is fed with three signals—the carrier signal and the output of each oscillator. As a result, third order mixing takes place with an intermediate frequency of 12 kc being the desired output. Elimination of all the undesired mixer products is insured by the 12 kc IF filter which follows the mixer stage.

Decision Module Guarantees Security and Reliability

The Motorola MC-22 Baseband Relaying Multiplex Receiver contains circuitry which prevents false tripping, and which gives an alarm whenever any of the following conditions occur:

- Low carrier signal, or absence of signal
- Improper signal-to-noise ratio
- Power failure
- Open circuit in either the Trip or Guard keyer circuit, including the relay coils
- Transistor failure

De-energization of the alarm relay (always energized under normal operating conditions to maintain the Alarm contacts open), and the functioning of an additional safety circuit which short circuits the Trip coil of the output relay (to prevent false trip under conditions of heavy noise signal or transistor failure) is dictated by the circuitry of the Decision Module. The abnormal conditions previously cited, in addition to causing alarm contact closure, will also set up a low resistance shunt around the Trip relay coil in order to prevent the false tripping of the controlled circuit breaker.

Fail-Safe Design

A further fail-safe provision is found in the mechanical construction of the output relay: This relay is spring-biased in the Guard direction so that complete power failure to the Receiver will result in the Guard contacts of the output relay remaining closed, thus obviating inadvertent closure in the Trip direction.

Although the false trip of a circuit breaker is virtually impossible, a normal Trip signal will be transmitted with reliability and speed. » » »

DADE COUNTY, FLA., TO INSTALL VHF, MICROWAVE CD NETWORK

Dade County, Florida has contracted for the installation of microwave and VHF communications equipment to be used to establish a Civil Defense disaster communications network.

The approximately quarter-million dollar contract consists of four 250-watt base stations in the 450 mc band, two 60-watt base stations, and 160 mobile units, including 40 motorcycle "Dispatcher" radiophones.

The base station system is to be in the form of a diamond with units located at the east, west, north and south boundaries of the county. The dispatcher center will be located at the eastern point, the Dade County Courthouse. A 6000 mc microwave loop system, providing for independent control of any base station, will connect the four points.

Civil Defense headquarters is to be established at the western point of the diamond and will include an auxiliary dispatcher station for emergencies.

In addition, a Motorola "Quik-Call" selective signalling system is being installed to provide individual contact with patrol cars. This feature will also be used to automatically turn on the flashing red light on top of the patrol car in order to summon the officer if he has temporarily left his vehicle. » » »

RADIO EQUIPMENT REPORTED MISSING

The New York Central Railroad has reported theft of three Motorola "Handie-Talkie" portable radiophones. The units include two H2310 models with Serial Numbers 6848 and 6850, transmitting on 160.41 mc. and receiving on 161.73 mc. These units are missing from the railroad's Indianapolis Hill Yard. The third unit, Serial No. 6944, is a H23-10 unit, transmitting on 159.57 mc. and receiving on 160.89 mc. This unit was stolen from the Indianapolis Brightwood Yard.

Information on these units should be forwarded to F. A. Ahrend, Supt. Communications, New York Central Railroad, in Indianapolis, Indiana.

The U. S. D. I., Bureau of Indian Affairs, has reported the loss of the following items from its Warm Springs agency: Motorola Packset, complete, Serial No. 1184, Property No. 99-198; Motorola Packset, without battery holder, Serial No. 1284, Property No. 967; Hickok Tube Tester, Serial No. 2031046, Property No. 99-1376.

Information on these units should be sent to R. H. Schoenhut, Property Management Officer, U. S. D. I., Bureau of Indian Affairs; Portland Area Office; Post Office Box 4097; Portland 8, Oregon.

Roland Construction Co., Alexandria, Louisiana, has reported theft of a Motorola T-41GGV-1 mobile radio with serial number 5585. This unit is equipped for operating on 49.7 mc. Information on this unit should be sent to R. I. Roland at the Roland Construction Co.

Three Motorola model H23-10 "Handie - Talkie" radiophones have been stolen from the Vandenburg Air Force Base. These units are the property of the Douglas Aircraft Co., Inc., and carry serial numbers of 4336, 4337 and 4338.

Motion Picture Radio Service of Phoenix has reported the theft of a Motorola D33-1 Industrial "Dispatcher" radio, Serial No. 8641, operating on a frequency of a Frequency 152.93 mc. was stolen while in use "on location" near Phoenix, Arizona. Unit can be further identified by a speaker phone jack installed directly above the microphone receptacle. Information on this unit should be referred to Willard Starr, 1347 5th Avenue, Los Angeles 19, California.

The New Jersey State Department of Conservation and Economic Development has reported the theft of two Motorola Model H23-4 "Handie-Talkie" radiophones with serial numbers 8925 and 8926, and one GE unit, model HF31W6, serial number AMO-318. Information on these units should be forwarded to the Bureau of Navigation at Lake Hopatcong, New Jersey.

TRANSMISSIONS ON MOTOROLA PERSONNEL

R. LaVance Carson

Haakon Herigstad

Haakon Herigstad and R. LaVance Carson have been named regional sales managers for Motorola Communications and Electronics, Inc.

Haakon Herigstad has been named regional sales manager for Motorola Communications & Electronics, Inc., for the six state area of North Dakota, South Dakota, Nebraska, Iowa, Minnesota and a part of Wisconsin.

Herigstad, who has been a zone manager in Iowa, joined Motorola in 1948. As regional manager, he will supervise sales of 2-way radio and other communications equipment to transportation, public safety and commercial and industrial organizations.

His office is at 2101 Hennepin Ave., Minneapolis, Minnesota.

R. LaVance Carson has been named regional sales manager for Motorola Communications & Electronics, Inc., for the four state area of Mississippi, Alabama, Georgia and Tennessee.

Carson, with Motorola for more than five years, was formerly an account executive in Baton Rouge, Louisiana. He had been named a Motorola zone sales manager in 1956.

In his new position, Carson supervises sale of 2-way radio and other communications equipment to public safety, transportation, commercial and industrial organizations.

His office is at 1389 Peachtree Street, Atlanta, Georgia. » » »

MOTOROLA NEWS GRAM

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Communications Division

SALES SERVICE directory of MOTOROLA AREA and REGIONAL OFFICES

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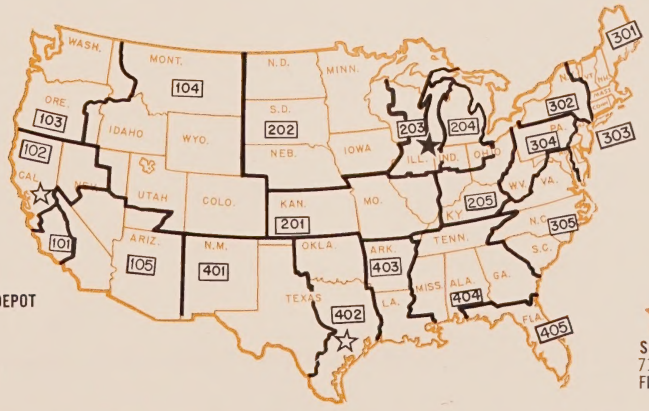

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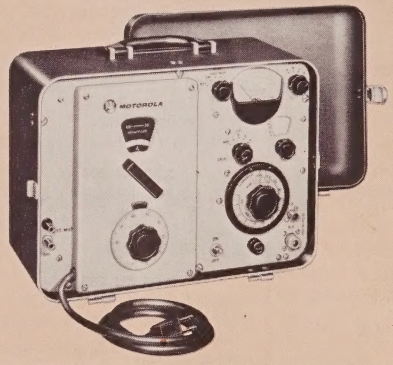
Specifically designed for both shop and field use, these high-quality instruments combine the laboratory precision required for critical electronic equipment testing with completely new advances in versatility and lightweight design.

T1020A PORTABLE FREQUENCY AND DEVIATION METER



T1034A FM SIGNAL GENERATOR

Despite its light weight and relatively small size, this unit covers the entire range of 20-1000 mc . . . even making it possible to service 960 mc microwave equipment. In addition to measuring and generating frequencies up to and even beyond 1000 mc by means of harmonic devices with a fundamental range of 20-40 mc, it can also be used to measure frequencies below 20 mc by using a harmonic of the unknown frequency. The T1020A unit has a guaranteed direct reading of 0.002% (two parts per million) when used to measure or generate any frequency within its range. By means of a correction curve, this accuracy can be improved to 0.0001% (one part per million), exceeding new FCC frequency tolerances by five times.

Dual range, peak reading DEVIATION METER measures deviations of 7.5 and 15 kc full scale over 20-1000 mc range with accuracy of ±5% full scale. Unit measures 15 x 12½ x 13 inches—weighs approximately 40 lbs.

Unit is ideal for use in servicing FM mobile, portable, fixed and aircraft 2-way radio; for manufacturing operations; and for research on FM, multiplexing and telemetering equipment.

The Motorola FM signal generator covers RF frequencies in six bands: 25-32, 32-41, 41-54, 140-175, 400-470 and 890-960 mc. To prevent errors in setting frequencies, frequency ranges not in use are concealed by a switch plate. Each range is individually calibrated to an accuracy of ±0.5%. By means of a vernier dial having 100 divisions, frequency can be tuned with a very high degree of precision.

Four IF oscillator frequency bands, each individually calibrated to an accuracy of ±0.5%, are provided. These, and harmonics, can be used to cover most IF frequencies in use today. Unit measures 11½ x 15⅛ x 10¾ inches and weighs only 30 lbs.

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